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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/573,942	03/29/2006	Akinobu Sato	NAA237	5411

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Intellectual Property Law Office of David Lathrop
No. 827
39120 Argonaut Way
Fremont, CA 94538

EXAMINER	
BAND, MICHAEL A	
ART UNIT	PAPER NUMBER
1723	

MAIL DATE	DELIVERY MODE
07/19/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/573,942	SATO ET AL.	
	Examiner	Art Unit	
	MICHAEL BAND	1723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 May 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-24* is/are pending in the application.

4a) Of the above claim(s) *24* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 May 2011* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/29/2006; 5/23/2011*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed 3/29/2006 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; **each non-patent literature publication** (emphasis added) or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. Currently none of the non-patent literature mentioned in this IDS form have been filed by the Applicant. The non-patent literature of both Toyoda references has been considered and cited in the accompanying Notice of References Cited form. However the non-patent literature of Yamada et al has not been considered.

Specification

2. The substitute specification filed 5/23/2011 has been entered.

Drawings

3. The drawings were received on 5/23/2011. These drawings are accepted.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 16-21 and 23 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 16 requires 'an orthographically-projected direction'. There is no support in the Specification for this requirement. Claim 23 requires irradiating so that the solid after irradiation has a thickness greater than or equal to 10 nm. There is no support for this requirement in the Specification. The Examiner notes that Applicant's Specification does teach 'the result of S atoms had only penetrated to a depth of something like 10 nm from the surface' on para 0047 and 'the etching amount does not exceed 10 nm' at para 0065 of Applicant's US 2006/0278611.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 16-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "orthographically-projected direction" in claim 16 is a term which renders the claim indefinite. The term "orthographically" is not defined by the claim, the Specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unknown what Applicant is claiming or how to interpret since the definitions of 'orthography' by *Merriam-Webster Online Dictionary* (see citation in References Cited) are:

1a. the art of writing words with the proper letters according to standard usage

1b. the representation of the sounds of a language by written or printed symbols

2. a part of language study that deals with letters and spelling

Since Applicant has not defined or provided any insight in the Specification as to how to interpret the term 'orthographically' and common definitions do not provide one of ordinary skill as to how to interpret 'orthographically', claim 16, along with corresponding dependent claims 17-20, are deemed unexaminable.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 14-15 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiramoto et al (WO 03/001614), equivalent to Matsukawa et al (US 2004/0086752 cited below), in view Dykstra et al (US Patent No. 6,624,081).

With respect to claims 14-15 and 21-24, Matsukawa et al discloses surface roughness can be suppressed (i.e. smoothed) on a semiconductor substrate with ion milling at a low angle or irradiating with a gas cluster ion beam, where the irradiating may be performed so that an angle of incidence of the ion beam at the surface is 5° to 25° and is capable of having an angle of incidence between 0° and 90° (p. 1, para 0005; p. 3, para 0034). Matsukawa et al also discloses that the thickness of the underlying film

after irradiation is between 100 nm to 2 μm (p. 2, para 0031; p. 3, para 0034). However Matsukawa et al is limited in that varying the angles of the gas cluster ion beam is not suggested.

Dykstra et al teaches enhanced etching/smoothing of a surface of a semiconductor substrate via gas cluster ion beam (GCIB) (abstract), where the ion beam is composed of argon gas (col. 5, lines 4-5). Figs. 3-4 depict a scanning system [47] to uniformly scan in a scanning pattern (i.e. repeating scan one or more times) the GCIB across large areas to produce spatially homogenous results (col. 5, lines 40-49). Dykstra et al further teaches the GCIB initially directed along a preselected axis where said GCIB is directed offset from the preselected axis (abstract), where fig. 4 depicts a fixed offset angle [68] between the preselected axis and total scanning GCIB [65]. Dykstra et al also teaches that while an example of the offset angle [68] is 15° from the preselected axis (i.e. GCIB hits the substrate [41] at an angle of 75°), other larger angles than 15° may be used (col. 7, lines 29-36).

It would have been obvious to one of ordinary skill to incorporate scanning at different angles as taught by Dykstra et al for the scanning at a single angle of Matsukawa et al to gain the advantage of producing spatially homogenous results.

Regarding claims 14-15, 21, and 23, the combination of references teaches smoothing at an initial angle of 5° to 25° and capable of smoothing up to an angle of 90° (Matsukawa reference) and then scanning 15° from said initial angle to a different angle (Dykstra et al reference). Therefore it is obvious that the combination of references teaches irradiating at a second angle of 40° prior to then scanning at a first angle of 25°

and then repeating the second angle and the first angle to result in the scanning pattern. It is well known and obvious that a semiconductor surface is composed of Ni, Si, and/or SiO_2 (i.e. thermal oxide) and has features such as trenches (i.e. concave portions) (p. 3, para 0037-0039).

10. Claims 14-15 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiramoto et al (WO 03/001614), equivalent to Matsukawa et al (US 2004/0086752) cited below), in view Erickson et al (US Patent No. 7,064,927).

With respect to claims 14-15 and 21-24, Matsukawa et al discloses surface roughness can be suppressed (i.e. smoothed) on a semiconductor substrate with ion milling at a low angle or irradiating with a gas cluster ion beam, where the irradiating may be performed so that an angle of incidence of the ion beam at the surface is 5° to 25° and is capable of having an angle of incidence between 0° and 90° (p. 1, para 0005; p. 3, para 0034). Matsukawa et al also discloses that the thickness of the underlying film after irradiation is between 100 nm to 2 μm (p. 2, para 0031; p. 3, para 0034). However Matsukawa et al is limited in that varying the angles of the gas cluster ion beam is not suggested.

Erickson et al teaches a method of smoothing a semiconductor substrate via beam of gas clusters to remove asperities (abstract), where the gas cluster beam is composed of an inert gas such as argon (col. 5, lines 16-27). Fig. 4 depicts the gas cluster ion beam [64] impacting the semiconductor substrate [52] by sweeping at different trajectories that can be repeated (i.e. sweeping pattern) (col. 5, lines 55-67; col. 6, lines 1-2). Fig. 4 also depicts that the gas cluster ion beam [64] is projected at an

initial incident angle of 0°, where the trajectories of said gas cluster ion beam [64] appear to be swept at a different angle less than 90°. Erickson et al cites the advantages of using the gas cluster ion beam at different trajectories as smoothing laterally without appreciable subsurface damage by removing surface roughness or asperities in addition to removing pits or crevices (col. 6, lines 15-18).

It would have been obvious to one of ordinary skill to sweep the gas cluster beam at different trajectories repeatedly as taught by Erickson et al for the single trajectory of Matsukawa et al to gain the advantages of smoothing laterally without appreciable subsurface damage by removing surface roughness or asperities in addition to removing pits or crevices.

Regarding claims 14-15, 21, and 23, the combination of references teaches smoothing at an initial angle of 5° to 25° and capable of smoothing up to an angle of 90° (Matsukawa reference) and then sweeping across different trajectories (i.e. angles) to a different angle (Erickson et al reference). Therefore it is obvious that the combination of references teaches irradiating at a second angle of 40° prior to then sweeping to a first angle of 5°-25° and then repeating the second angle and the first angle to result in the sweeping pattern. It is well known and obvious that a semiconductor surface is composed of Ni, Si, and/or SiO_2 (i.e. thermal oxide) and has features such as trenches (i.e. concave portions) (p. 3, para 0037-0039).

11. Claims 14-15 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitani (*Incident Angle Dependence of the Sputtering Effect of Ar-cluster Ion Bombardment*) in view of Dykstra et al (US Patent No. 6,624,081).

With respect to claims 14-15 and 21-24, Kitani discloses gas cluster ions impacting a solid surface for smoothing using several different incident angles (abstract). Kitani further discloses that incident angles from 0° to 60° (i.e. 90° to 30° angle formed between surface and ion beam) were tried, measured from the surface normal (i.e. perpendicular to the surface) of a semiconductor substrate (p. 490, left column). Kitani also discloses that larger angles than 45° can be used since the desired smoothing effect is dependent on the incident angle (p. 491, right column), thus the angle used for the smoothing is a result-effective variable, with it being held that a particular parameter must first be recognized as a result-effective variable, i.e. a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. See MPEP 2144.05, Section II, Part B. Kitani also discloses that after irradiation, thicknesses between 44-113 angstroms (4.4-11.3 nm) were observed (fig. 2). However Kitani is limited in that varying the angles of the gas cluster ion beam is not suggested.

Dykstra et al teaches enhanced etching/smoothing of a surface of a semiconductor substrate via gas cluster ion beam (GCIB) (abstract), where the ion beam is composed of argon gas (col. 5, lines 4-5). Figs. 3-4 depict a scanning system [47] to uniformly scan in a scanning pattern (i.e. repeating scan one or more times) the GCIB across large areas to produce spatially homogenous results (col. 5, lines 40-49). Dykstra et al further teaches the GCIB initially directed along a preselected axis where said GCIB is directed offset from the preselected axis (abstract), where fig. 4 depicts a fixed offset angle [68] between the preselected axis and total scanning GCIB [65].

Dykstra et al also teaches that while an example of the offset angle [68] is 15° from the preselected axis (i.e. GCIB hits the substrate [41] at an angle of 75°), other larger angles than 15° may be used (col. 7, lines 29-36).

It would have been obvious to one of ordinary skill to incorporate scanning at different angles as taught by Dykstra et al for the scanning at a single angle of Kitani to gain the advantage of producing spatially homogenous results.

Regarding claims 14-15, 21, and 23, the combination of references teaches smoothing at an initial angle between of 90-30° (Kitani reference) and then scanning 15° from said initial angle to a different angle (Dykstra et al reference). Therefore it is obvious that the combination of references teach irradiating at an angle of 40° prior to then scanning at the initial fixed angle of 25° to result in the scanning pattern. Therefore it is obvious that the combination of references teaches irradiating at a second angle of approximately 45° prior to then scanning at a first angle of approximately 30° and then repeating the second angle and first angle to result in the scanning pattern. It is well known and obvious that a semiconductor surface is composed of Ni, Si, and/or SiO_2 (i.e. thermal oxide) and has features such as trenches (i.e. concave portions).

12. Claims 14-15 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitani (*Incident Angle Dependence of the Sputtering Effect of Ar-cluster Ion Bombardment*) in view of Erickson et al (US Patent No. 7,064,927).

With respect to claims 14-15 and 21-24, Kitani discloses gas cluster ions impacting a solid surface for smoothing using several different incident angles (abstract). Kitani further discloses that incident angles from 0° to 60° (i.e. 90° to 30°

angle formed between surface and ion beam) were tried, measured from the surface normal (i.e. perpendicular to the surface) of a semiconductor substrate (p. 490, left column). Kitani also discloses that larger angles than 45° can be used since the desired smoothing effect is dependent on the incident angle (p. 491, right column), thus the angle used for the smoothing is a result-effective variable, with it being held that a particular parameter must first be recognized as a result-effective variable, i.e. a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. See MPEP 2144.05, Section II, Part B. Kitani also discloses that after irradiation, thicknesses between 44-113 angstroms (4.4-11.3 nm) were observed (fig. 2). However Kitani is limited in that varying the angles of the gas cluster ion beam is not suggested.

Erickson et al teaches a method of smoothing a semiconductor substrate via beam of gas clusters to remove asperities (abstract), where the gas cluster beam is composed of an inert gas such as argon (col. 5, lines 16-27). Fig. 4 depicts the gas cluster ion beam [64] impacting the semiconductor substrate [52] by sweeping at different trajectories that can be repeated (i.e. sweeping pattern) (col. 5, lines 55-67; col. 6, lines 1-2). Fig. 4 also depicts that the gas cluster ion beam [64] is projected at an initial incident angle of 0°, where the trajectories of said gas cluster ion beam [64] appear to be swept at a different angle less than 90°. Erickson et al cites the advantages of using the gas cluster ion beam at different trajectories as smoothing laterally without appreciable subsurface damage by removing surface roughness or asperities in addition to removing pits or crevices (col. 6, lines 15-18).

It would have been obvious to one of ordinary skill to sweep the gas cluster beam at different trajectories repeatedly as taught by Erickson et al for the single trajectory of Kitani to gain the advantages of smoothing laterally without appreciable subsurface damage by removing surface roughness or asperities in addition to removing pits or crevices.

Regarding claims 14-15, 21, and 23-24, the combination of references teaches smoothing at an initial angle between of 90-30° (Kitani reference) and then sweeping across different trajectories (i.e. angles) to a different angle (Erickson et al reference). Therefore it is obvious that the combination of references teaches irradiating at a second angle of 45° prior to then sweeping at a first angle of 30° and then repeating the second angle and the first angle to result in the sweeping pattern. It is well known and obvious that a semiconductor surface is composed of Ni, Si, and/or SiO_2 (i.e. thermal oxide) and has features such as trenches (i.e. concave portions).

13. Claims 14-15 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoehn et al (USPGPub 2002/001680) in view of Dykstra et al (US Patent No. 6,624,081).

With respect to claims 14-15 and 21-22, Hoehn et al discloses using a beam generator to break molecular bonds on a semiconductor substrate (abstract; p. 3, para 0026), where figs. 2-4 depicts the beam generator [250] breaking said molecular bonds to smooth into a single molecular layer. Fig. 3 also depicts the beam generator operating [250] at an angle [θ] formed between a solid surface [202] and said ion beam generator being between 25° and 75°, where said beam generator [250] is a gas cluster

ion beam using argon gas (para 0041-0042; claim 6). Since it has been held that where the claimed range (i.e. less than 30°) ‘overlap or lie inside ranges disclosed by the prior art (i.e. 25° to 75°)’ a *prima facie* case of obviousness exists. see MPEP 2144.05, Section I. Therefore it is either inherent or obvious that Hoehn et al discloses using a gas cluster ion beam at an angle formed between the solid surface [202] and the ion beam generator [250] less than 30° (i.e. between 25° and 29°). Hoehn et al also discloses that while the monolayer thickness is preferably between 0.5-1 nm after irradiation, it is known in the prior art for the fullerenes to have the thickness between 3-15 nm (p. 1, para 0009; p. 3, para 0027). However Hoehn et al is limited in that varying the angles of the gas cluster ion beam is not suggested.

Dykstra et al teaches enhanced etching/smoothing of a surface of a semiconductor substrate via gas cluster ion beam (GCIB) (abstract), where the ion beam is composed of argon gas (col. 5, lines 4-5). Figs. 3-4 depict a scanning system [47] to uniformly scan in a scanning pattern (i.e. repeating scan one or more times) the GCIB across large areas to produce spatially homogenous results (col. 5, lines 40-49). Dykstra et al further teaches the GCIB initially directed along a preselected axis where said GCIB is directed offset from the preselected axis (abstract), where fig. 4 depicts a fixed offset angle [68] between the preselected axis and total scanning GCIB [65]. Dykstra et al also teaches that while an example of the offset angle [68] is 15° from the preselected axis (i.e. GCIB hits the substrate [41] at an angle of 75°), other larger angles than 15° may be used (col. 7, lines 29-36).

It would have been obvious to one of ordinary skill to incorporate scanning at different angles as taught by Dykstra et al for the scanning at a single angle of Hoehn et al et al to gain the advantage of producing spatially homogenous results.

Regarding claims 14-15 and 21, the combination of references teaches smoothing at an initial angle of 25° to 75° (Hoehn et al reference) and then scanning 15° from said initial angle to a different angle (Dykstra et al reference). Therefore it is obvious that the combination of references teaches irradiating at a second angle of 40° prior to then scanning at a first angle of 25° and repeating the second angle and first angle to result in the scanning pattern. It is well known that a semiconductor surface comprises features such as trenches (i.e. concave portions).

14. Claims 14-15 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoehn et al (USPGPub 2002/001680) in view of Erickson et al (US Patent No. 7,064,927).

With respect to claims 14-15 and 21-22, Hoehn et al discloses using a beam generator to break molecular bonds on a semiconductor substrate (abstract; p. 3, para 0026), where figs. 2-4 depicts the beam generator [250] breaking said molecular bonds to smooth into a single molecular layer. Fig. 3 also depicts the beam generator operating [250] at an angle [θ] formed between a solid surface [202] and said ion beam generator being between 25° and 75°, where said beam generator [250] is a gas cluster ion beam using argon gas (para 0041-0042; claim 6). Since it has been held that where the claimed range (i.e. less than 30°) ‘overlap or lie inside ranges disclosed by the prior art (i.e. 25° to 75°)’ a *prima facie* case of obviousness exists. see MPEP 2144.05,

Section I. Therefore it is either inherent or obvious that Hoehn et al discloses using a gas cluster ion beam at an angle formed between the solid surface [202] and the ion beam generator [250] less than 30° (i.e. between 25° and 29°). Hoehn et al also discloses that while the monolayer thickness is preferably between 0.5-1 nm after irradiation, it is known in the prior art for the fullerenes to have the thickness between 3-15 nm (p. 1, para 0009; p. 3, para 0027). However Hoehn et al is limited in that varying the angles of the gas cluster ion beam is not suggested.

Erickson et al teaches a method of smoothing a semiconductor substrate via beam of gas clusters to remove asperities (abstract), where the gas cluster beam is composed of an inert gas such as argon (col. 5, lines 16-27). Fig. 4 depicts the gas cluster ion beam [64] impacting the semiconductor substrate [52] by sweeping at different trajectories that can be repeated (col. 5, lines 55-67; col. 6, lines 1-2). Fig. 4 also depicts that the gas cluster ion beam [64] is projected at an initial incident angle of 0°, where the trajectories of said gas cluster ion beam [64] appear to be swept at a different angle less than 90°. Erickson et al cites the advantages of using the gas cluster ion beam at different trajectories as smoothing laterally without appreciable subsurface damage by removing surface roughness or asperities in addition to removing pits or crevices (col. 6, lines 15-18).

It would have been obvious to one of ordinary skill to sweep the gas cluster beam at different trajectories repeatedly as taught by Erickson et al for the single trajectory of Matsukawa et al to gain the advantages of smoothing laterally without appreciable

subsurface damage by removing surface roughness or asperities in addition to removing pits or crevices.

Regarding claims 14-15 and 21, the combination of references teaches smoothing at an initial angle of 25° to 75° (Hoehn reference) and then sweeping across different trajectories (i.e. angles) to a different angle (Erickson et al reference). Therefore it is obvious that the combination of references teaches irradiating at a first angle range of approximately 30°-40° prior to then sweeping at a first angle of 25° and repeating the second angle and first angle to result in the sweeping pattern. It is well known that a semiconductor surface comprises features such as trenches.

15. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hoehn et al (USPGPub 2002/001680) in view of Kumar (*Novel caged clusters of silicon: Fullerenes, Frank-Kasper polyhedron and cubic*).

With respect to claim 23, Hoehn et al discloses using a beam generator to break molecular bonds on a semiconductor substrate (abstract; p. 3, para 0026), where figs. 2-4 depicts the beam generator [250] breaking said molecular bonds to smooth into a single molecular layer. Fig. 3 also depicts the beam generator operating [250] at an angle [θ] formed between a solid surface [202] and said ion beam generator being between 25° and 75°, where said beam generator [250] is a gas cluster ion beam using argon gas (para 0041-0042; claim 6). Since it has been held that where the claimed range (i.e. less than 30°) 'overlap or lie inside ranges disclosed by the prior art (i.e. 25° to 75°)' a *prima facie* case of obviousness exists. see MPEP 2144.05, Section I. Therefore it is either inherent or obvious that Hoehn et al discloses using a gas cluster

ion beam at an angle formed between the solid surface [202] and the ion beam generator [250] less than 30° (i.e. between 25° and 29°). However Hoehn et al is limited in that while it suggested that any molecule with carbon fullerene-like properties can be used (p. 5, para 0051), specific examples of these molecules are not suggested.

Kumar teaches silicon as a Si_{20} and Si_{16} molecule cages and are similar to a carbon fullerene, where the Si_{16} is lighter than the carbon fullerene with high stability (abstract; p. 2, Results section). Kumar also teaches that a Si_{15} surrounding Cr exhibited strong stable bonds (p. 111, right column).

It would have been obvious to one of ordinary skill in the art to substitute the Si_{16} cage as taught by Kumar for the carbon fullerene of Hoehn et al to gain the advantage of a lighter molecule with high stability.

Response to Arguments

IDS

16. Applicant has still not filed any of the non-patent literature cited in the IDS filed 3/29/2006.

Specification

17. Applicant has submitted a new title for the invention; the title has been accepted.

Drawings

18. Applicant has cancelled the objected subject matter; the new drawings are accepted.

112 Rejections

19. Applicant has cancelled the rejected claims; the rejections are moot.

102 and 103 Rejections

20. Applicant's arguments with respect to claims 14-24 have been considered but are moot in view of the ground(s) of rejection due to the new claims requiring new limitations, such as requiring steps b and c, which have been addressed in the rejections above.

Conclusion

21. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 9am-5pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

23. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./

Examiner, Art Unit 1723

/Alexa D. Neckel/
Supervisory Patent Examiner, Art Unit 1723